Remarks

Claim Status and Amendments

Claims 1-8, 10-13 and 15-40 are currently pending in the application. Claims 1-7, 15-27 and 29-40 stand rejected. Claims 8 and 28 are objected to. Applicants hereby amend Claims 1 and 15 to clarify the claimed invention. Applicants submit that the amendments to claims 1 and 15 introduce no new matter. Accordingly, claims 1-8, 10-13 and 15-40 are pending and presented for consideration.

Applicants' Claimed Invention

The present invention, as claimed in amended claims 1 and 15, relates to an apparatus and a corresponding method for monitoring electric motors. In particular, the apparatus comprises an antenna and a processor wherein the antenna provides a non-contact means for detecting radio frequency signals generated during the operation of the electric motor. As detailed in the specification as filed on page 5, paragraph 3 through page 8, paragraph 3, a number of factors influence "the ability of the arc to form, the duration of the arc and the arc intensity", see page 8, line 6 and 7.

Processing of the "radio frequency signals generated by the arcing events in the electric motor" by the processor provides a means for determining one or more operational parameters of the electric motor. Put another way, the profile of the radio frequency signals generated by the arcing events in the electric motor allows for the measurement of a range of DC and AC electric motor diagnostics e.g. motor speed, acceleration or torque, and facilitates the location and identification of both electrical and mechanical faults within the electric motor.

The apparatus and method of amended claims 1 and 15, respectively, thus provide a portable, adjustable and non-intrusive means of measuring operational parameters of the electric motor.

Rejections Under 35 USC § 103: Blades in view of Canada

Claims 1-4, 7, 15, 16, 18-20, 22-27 and 29-40 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,434,509 to Blades ("Blades") in view of U.S. Patent No. 6,138,078 to Canada *et al.* ("Canada").

Blades relates to the field of detectors of electrical arcs on power lines to provide advanced warning of potentially dangerous conditions. See Blades, col. 1, lines 19 to 21. An object of Blades' invention, as stated at col. 1, lines 32 to 36, is to provide "a method and apparatus to detect such potentially dangerous arcs by monitoring voltage disturbances on the power lines". Blades' specification distinguishes line fault arcing, stating that it is unlikely to cause a fire in the supply line, with contact arcing, which results from a high resistance connection in series with a load being present and is prone to cause fires on power lines. See Blades, col. 1, lines 38 to 49.

Blades recites at col. 4, lines 27 to 35 that:

> The arc detector of the present invention monitors either the line voltage, the line current, or energy radiated from the power line for the presence of high-frequency noise exhibiting certain distinctive patterns which have been discovered by the inventor to be characteristic of contact arcing, and in this manner produces an output responsive to the presence of contact arcing. This output may be used to activate an alarm or to interrupt current to the arc.

Important to the correct operation of Blades' invention is the fact that electrical arcing produced by an alternating voltage will extinguish each time the voltage across the arc drops below a value sufficient to sustain the arc, and will re-ignite each time the voltage across the arc exceeds the arc's ignition voltage. Therefore, arcs sustained by an alternating power source will necessarily extinguish at least twice every full cycle of the power source frequency. See Blades, col. 4, lines 36 to 43 and Figures 2, 3 and 5.

Blades continues at col. 4, lines 55 to 63, stating that:

> During the time the arc is conducting current, it produces wideband, high-frequency noise ranging from about 10 KHz to perhaps 1 GHz. During the time the arc is not conducting current, i.e., during the gaps, it produces no noise. The present inventor has realized that the resulting characteristic pattern of high-frequency noise with synchronous gaps is unique to arcing and that therefore an algorithm for analyzing repetitive patterns in the noise can be used to detect arcing.

According to the general method of Blades' invention, either the line voltage or the load current of a power line is monitored and the high-frequency noise extracted. The extracted noise is then monitored for the presence of gaps conforming to one of several "patterns" or "features"

that occur at intervals equal to an integral multiple of one-half the line voltage period T. Commonly, spacing of the gaps at intervals of T is required as a condition of detection of arcing. For example, in one embodiment of the arcing detection algorithm, a "signature" potentially indicative of contact arcing is determined to exist if a predetermined number of gaps are found to occur spaced by successive intervals of length T. If the signature persists long enough, and/or meets certain further qualifying conditions, potentially dangerous arcing is determined to exist.

Of particular relevance to Applicants' invention is the section of Blades dedicated to the problem of avoiding false indications of dangerous arcing conditions due to noise from other sources, e.g. short-lived impulse noise from lamp dimmers, switching power supplies and the like; interference from local AM radio broadcast stations; arcing in electric motors with brush contacts; and communication signals from carrier-current transmitters. See Blades, col. 18, line 26 to col. 19 line 5. Each of these noise sources is described by Blades as being problematic and Blades describes various techniques to remove the presence of these noise sources from the high-frequency signal extracted from the power line.

Importantly, Blades states that the noise produced by an electric motor does not ever go to zero; it is present throughout the cycle. See Blades, col. 18, lines 55 to 57. Thus, "the lack of a gap in each half-cycle of the line frequency prevents false triggering of the arc detection device," as described in each of Blades' described operating methods. See Blades, col. 18, lines 59 to 62.

Applicants respectfully submit that the Office action misinterprets the teachings of Blades. Specifically, Blades neither teaches "an electric motor monitoring system" nor "a method for monitoring an electric motor" as claimed in claims 1 and 15. Instead, Blades' described apparatus and methods are employed solely for use with power lines.

Furthermore, the person skilled in the art is actively led away from employing the method and apparatus taught by Blades to an electric motor. In fact, Blades teaches that its apparatus and methods are not capable of being employed with electric motors since the radio frequency signals generated by such motors do not produce the required "gaps" for monitoring the arcing events. It is this very fact which allows noise from such sources to be rejected, a fact further supported by the Object of the Invention in Blades, col. 3, lines 64 to col. 4, line 2, which states:

> It is therefore an object of the present invention to provide a method for monitoring line voltage, load current, or energy radiated from the power conductors, whereby persistent arcing that may potentially cause a fire may be detected, while noise on the power line from other sources, such as **electric motors**, switch closures, lamp dimmers, or **communication systems** is rejected. [emphasis added]

Canada relates to the field of machine monitors and, in particular, to an electric motor monitor capable of sensing and analysing various stresses experienced by the motor during the life of the motor.

Canada's monitors (100 and 101) comprise a plurality of sensors (460a-d) that are located in around the perimeter of both an electric motor (102) and an article of driven equipment (450). The sensors (460a-d) may include sensors, for sensing vibration, temperature and flux and are preferably tethered to the monitor (100) by cables. Alternatively, the external sensors (460a-d) are tethered by wireless means such as a radio frequency (RF) data links. See Canada, col. 13, line 30 to col. 14, line 60 and Figure 9.

Canada also teaches employing wireless IR data links, RF links, or computer network communication modules to allow the monitor (100) and 101) to communicate with a peripheral device e.g. the hub (554) and plant network (556) of Figure 10.

Canada is silent with respect to arcing events within the electric motor and to the detection of radio-frequency signals generated by such arcing events. As discussed above, the only reference in Canada to RF signals relates to the communication between a monitor (101) and its corresponding sensors (460a-d) or the monitor (100 and (101) and a peripheral device.

The Office action rejects the apparatus of claim 1 and the method of claim 15 as obvious in light of the combined teachings of Blades and Canada. Applicants traverse the rejections to the extent the rejections apply to the claims as amended.

First, the teachings of Blades and Canada are mutually exclusive for the reasons highlighted above. Blades neither teaches "an electric motor monitoring system" nor "a method for monitoring an electric motor"; Blades relates to apparatus and methods that are employed solely for monitoring power lines. Therefore, the person skilled in the art would not consider combining the teachings of these two documents.

However, if the person skilled in the art were motivated to combine the teachings of Canada and Blades, such a combination does not produce the presently claimed invention. The described arc detector of Blades is not capable of detecting the radio-frequency signals associated with arcing events within electric motors since these signals do not produce the required "gaps" for monitoring the arcing events.

Furthermore, the use of RF signals for "communication systems", as taught by Canada, would have a detrimental effect on the operation of the arc detector of Blades. Such RF signals would be a further source of noise which would require further action, such as signal processing, to avoid false indications of arcing.

Claims 1-4, 7, 15, 16, 18-20, 22-27 and 29-40 are rejected under 35 U.S.C. § 103(a) as allegedly being obvious in view of Blades and Canada. Claims 2-14 and 16-40 depend from and incorporate the requirements of independent claims 1 and 15. For at least the reasons stated above, Applicants respectfully request reconsideration and withdrawal of the rejections of claims 12 and 28-29 under 35 U.S.C. § 103(a) in light of Blades and Canada.

Rejections Under 35 USC § 103: Blades and Canada in further view of Lindsay

Claims 5 and 6 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Blades in view of Canada as applied to claim 1 above, and further in view of DE 003140319A1 to Lindsay *et al.* ("Lindsay"). Blades and Canada were discussed above. Lindsay does not cure the deficiencies of Blades and Canada. As such, Applicants submit that amended independent claims 1 and 15 are patentable over Blades and Canada in view of Lindsay. As claims 5 and 6 depend from claim 1, Applicants submit that claims 5 and 6 are further patentable over Blades and Canada in view of Lindsay.

Rejections Under 35 USC § 103: Blades and Canada in further view of Lu

Claim 17 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Blades in view of Canada as applied to claim 15 above, in further view of U.S. Patent No. 5,737,026 to Lu *et al.* ("Lu"). Blades and Canada were discussed above. Lu does not cure the deficiencies of Blades and Canada. As such, Applicants submit that amended independent claims 1 and 15 are

patentable over Blades and Canada in view of Lu. As claim 17 depends from claim 15, Applicants submit that claim 17 is further patentable over Blades and Canada in view of Lu.

Rejections Under 35 USC § 103: Blades and Canada in further view of Eryurek

Claim 21 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Blades in view of Canada as applied to claims 15 and 20 above, and further in view of U.S. Patent No. 6,701,274 to Eryurek *et al.* ("Eryurek"). Blades and Canada were discussed above. Eryurek does not cure the deficiencies of Blades and Canada. As such, Applicants submit that amended independent claims 1 and 15 are patentable over Blades and Canada in view of Eryurek. As claim 21 depends from claim 15, Applicants submit that claim 21 is further patentable over Blades and Canada in view of Eryurek.

Conclusion

Applicants respectfully submit that the foregoing arguments overcome the Examiner's rejections and that the pending claims are in condition for allowance. The Examiner is invited to contact Applicants' undersigned representative by telephone at the number listed below to discuss any outstanding issues.

Respectfully submitted,

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Reg. No. 58,343

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